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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTION OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION

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Forthcoming Events.

APRIL 13.

Institution of British Foundrymen (London Branch):—"Machine-Moulding Notions." Paper by A. R. Bartlett.

APRIL 26

Institution of British Foundrymen (London and District Branch):—"Making Castings without Feeding Heads," by E. Ronceray (Paris).

The Nomenclature of Personnel.

Almost perennially scientists devote much time in attempts to effect clear definitions of scientific terms with a view to prevent two people using the same terms in two different senses.

Curiously enough, despite real honest attempts, quite a number of words still admit of different interpretation by the various schools of thought, even as regards those which have reference to personnel. In the North of England the terms "manager" and "foreman" seem to be interchangeable.

We readily admit that a works organisation does not allow of an administration which incorporates the strict limitations of military service nomenclature, but we suggest that it should not be difficult to define clearly the spheres of the two men. Since soft collars became popular, this ridiculous means of affording a distinction no longer exists. We tentatively put forward the suggestion that if the foundry is such that the man in charge deals directly with the men, he is still foreman, and until the shop has grown to such a size that a person is interposed between the men and himself can he be called manager.

Recently there has been an attempt to restrict the at present too loose interpretation of the word "engineer." Whilst we do not ask for the strict limitations of the Continent, where the word is confined to only those having a technical school education, we do suggest that it should not relate to even poorly-skilled mechanics, as is often the case.

In this case we would limit the expression to technically-trained men and those who by industry have reached to the position of manager.

We anticipate that some will regard this as an attempt upon their liberties, but it is no such thing, because at the moment the word "engineer" is so loosely applied that it means nothing; whereas we consider it desirable that the expression should convey to outsiders that the person entitled to its use should be versed in something more than one small section of its practical application, such as fitting, erecting, or turning. At the moment a person announcing that he is an engineer is usually called upon to specify not only his branch but the nature of his specialisation, because the word conveys nothing. Fortunately the word "metallurgist" has not been debased in the English language to any serious extent, but incorrectly taking the word "métallurgiste" (and not ingénieur-métallurgiste, the true equivalent) as its French translation, then similar chaos exists in France, for the word seems to be equally applicable to mechanics, erectors, turners, moulders, or to any workman who is even remotely connected with the metallurgical or engineering industries. However, since they have the covering word "engineer," no poor description of occupation can come about. Perhaps the looseness of description in the English-speaking countries has one advantage; that is, a man is given employment on his experience and not upon a title, as sometimes happens on the Continent.

Pig-Iron Production of South Russia.—A recent statement in the Soviet papers is to the effect that the output of pig-iron in Southern Russia in 1921 was only 119,670 tons as compared with 4,474,737 tons in 1913. This last figure, however, is incorrect, as Southern Russia alone produced only 3,046,120 tons of pig-iron in 1913, the Urals coming next with 412,160 tons, and the Moscow district with 189,980 tons, leaving a small balance for Northern Russia to make up a total of 4,546,607 tons in the whole of Russia.

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Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Iron-Foundry Cupola Management.

To the Editor of The Foundry Trade Journal.

Sir,—I notice one of your correspondents in this week's issue expresses amusement *re* the account of the visit of the members of the London Branch of I.B.F. to the works at Isleworth, and winds up his letter by issuing a challenge.

The London members will remember I was very careful to emphasise that I had no interest in the sale of any make of cupola whatever. My lecture also contains reference to the fact there is other plant besides the cupola to consider in providing for best results.

One has no desire to make the lot of the foreman more unpleasant than what it is, and those who heard my lecture will also remember the effort was directed towards giving to those associated with the trade the benefit of one's experience for what it may be worth.

Not being a seller of cupolas, I am unable to take up Mr. Shaw's challenge, but can make this suggestion: I will undertake with the cupola at Isleworth, using the double row of tuyeres, instead of one row as was the case on March 9, to melt ten tons of iron at a ratio of not 1 to 17, but 1 to 20 exclusive of bed, using ordinary pig and ordinary scrap, on the understanding that Mr. Shaw shall pay for the entire cost of the melting if I am successful.

It may also interest Mr. Shaw to know I have a letter from the present Prime Minister to show I offered my services to the Ministry of Munitions during the war, but they were not accepted.

With regard to Mr. A. A. Liardet's letter, I think, as it has been suggested we may continue this subject at a later date, it would be helpful to use his arguments as a text for further reasoning.—Yours, etc.,

J. J. McClelland.

Palatine Works, Isleworth Road, Isleworth.
April 8.

Modern Steel Foundry Practice.

To the Editor of The Foundry Trade Journal.

Sir,—Having read with much interest the report as published in your columns on April 6 of the paper presented to the Manchester Metallurgical Society by Mr. Ernest Wells and the subsequent discussion on the subject of steel-production methods for steel castings, I thank you for space to add my comments and criticisms. The following may be of interest to Mr. Wells and your readers:—

(1) High-grade steel for intricate castings is being produced by the "Stock Converter" at a cost per ton in the ladle equal to that produced by at least one plant known to the writer by the electric furnace.

(2) On at least one "Stock Converter" plant of which the writer is conversant the average duration of melting of a two-ton charge of cold materials is 90 minutes.

(3) Steel scrap varying between 30 and 50 per cent. is being regularly charged into the "Stock Converter" plant, as referred to above.

(As a matter of metallurgical interest high-grade intricate steel castings have been produced experimentally by the "Stock Converter," giving excellent results on mechanical and hydraulic tests, from a charge consisting wholly of steel scrap, with materials added to give the necessary elements to the bath for the conversion process.)

(4) A minimum of 40 tons of steel in the ladle is being regularly produced in a "Stock Converter" plant of 2 tons capacity during a 47-hour working week.

(5) It is a common experience to pour "Stock Converter" steel from a bottom pouring ladle into a minimum of forty separate pouring heads (including the first cast of the day).

It is the writer's confirmed experience that no single furnace is fool-proof against producing steel with the common defects, blowholes, etc., but in taking all into consideration, including the human factor, scientific and metallurgical control, selection and quality of materials, proper adjustment of killing, pouring, and moulding methods, excellent steel castings can be produced from each or all of the standard processes of manufacture, including the converter processes.

It is also my opinion that of all the methods referred to in the article, the "Stock Converter." is eminently suitable for the production of steel castings on the smaller scale, including all considerations of cost, quality, and adaptability. Production in the "Stock Converter" can be greatly accelerated by the installation of an oil metal melter as an accessory to the plant.

With reference to Mr. Wells' statement (the converter steel was much more "lively," etc.) I would suggest the application of the terms "fluidity" and "liquidity" to liquid steel, and with these considerations in view these properties are common in a greater or less degree to liquid steels of varying manufacture, and certainly not less in the case of "electric steel," as is substantiated in practice. Temperature and chemical composition of the resulting liquid steel are, of course, important factors which govern to a large extent this phenomena.—Yours, etc.,

T. E. Hull,
President West Yorkshire Metallurgical Society.
26, Macaulay Road, Birkby,
Huddersfield.

Institution of British Foundrymen.

Birmingham Conference.

The following is a list of Papers to be submitted at the Birmingham Convention:—

(1) "Light Steel Castings," by H. Bradley (Sheffield).

(2) "Testing of Cast Iron," by E. Ronceray (Paris).

(3) "Semi-Steel," by J. Cameron (Kirkintilloch).

(4) "Casting of Brass and Bronze," by O. Smalley, M.I.M. (Newcastle-on-Tyne).

(5) Malleable Iron," by Prof. C. Touceda (U.S.A.).

(6) "Floor Moulding," by J. Varlet (Liége).

(7) Safety in Foundry Operations," by R. W. Patmore (Industrial Welfare Society, London).

(8) "Some Influences of Low Temperature on the Strength and Properties of Cast Iron," by A. Campion, F.I.C. (Falkirk), and J. W. Donaldson, D.Sc. (Greenock).

NOTES FROM THE BRANCHES.

Newcastle-on-Tyne and District.

A well-attended meeting was held in Newcastle on March 25, when Mr. Oliver Smalley, technical adviser to Sir W. G. Armstrong, Whitworth & Company, Limited, read a Paper on "Cast Iron and its Chemical Composition," illustrated with lantern slides. Nearly 200 members were present, and a good discussion followed. Four candidates were elected, making the total new members this year about 40.

The North-East Coast Institute of Shipbuilders and Engineers issued a special invitation to the members to attend a lecture on "Standardisation" by Mr. C. Le Maistre This was taken advantage of by many of the members.

Mr. George Vardy, M.B.E., past Branch President, has left for Spain for a month or two on a pleasure trip.

Sheffield.

Mr. H. Lewin (member) is shortly leaving this country to take up a position as Inspector of Castings for the Government of India. It will be remembered that Mr. Lewin was the winner of the second prize in a competition arranged by The Foundry Trade Journal for the design of a foundry, and it is interesting to note that this fact influenced the award of the position in Mr. Lewin's favour.

Harland & Wolff, Limited, have placed the crane contract for their new repair works at the Port of London with Alex. Chaplin & Company, Govan. Messrs. Chaplin have just completed a large order for overhead cranes for Messrs. Harland & Wolff's Clyde foundry.

How Pressed Steel Moulding Boxes Are Made.

Pressed steel moulding boxes, although well known to many founders, are not universally understood and appreciated to the extent which their many advantages merit.

Through Messrs. The Blackfriars Foundry Requisite and Equipment Company, of 181, Queen Victoria Street, London, E.C.4, who are the sole selling agents for England and Wales for these pressed steel moulding boxes, made by Messrs. Estler Brothers, our representative recently had the opportunity of following through the manufacture at the makers' works at Victoria Docks.

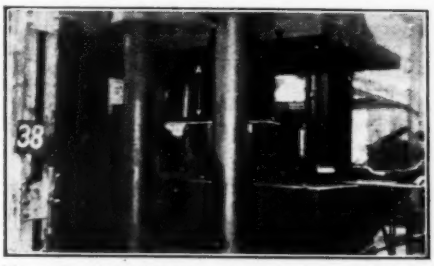

Fig. 1.—A 600-tons Hydraulic Press for Communicating Flange or Curvature to the Steel Strip.

Owing to the difficulty of obtaining suitable steel strip, mild steel plate of a suitable strength is used.

Lengths, equivalent to two sides of the box, are cut off by the usual type of plate shears.

The curvature or flanges are then given to the strips by a 600-ton hydraulic press, made by Messrs. David Budge & Company, illustrated in Fig. 1. The dies used for making the curvature or

Fig. 2.—One of the Smaller Presses for Bending the Curved or Flanged Skip at Right Angles. Several Pieces so Bent are Shown in the Foreground.

flanges are of cast iron and are shown at A, Fig. 1, and are made in the foundry attached to the works. The strips are then bent in hydraulic presses of 80 to 100 tons capacity, manufactured by Collis & Company, of London. There are several of these machines installed, one of which is shown in Fig. 2. As will be seen from the illustration, the boxes are made so that they require welding at the middle of two of the sides and not at the corners. This is an important point because the weld, which is obviously the weakest part of the box, is later reinforced by the handles and lugs. Two half-boxes are then "tacked" together by the quasi-arc welding process. Following this, each joint is electrically welded on both sides, and whilst

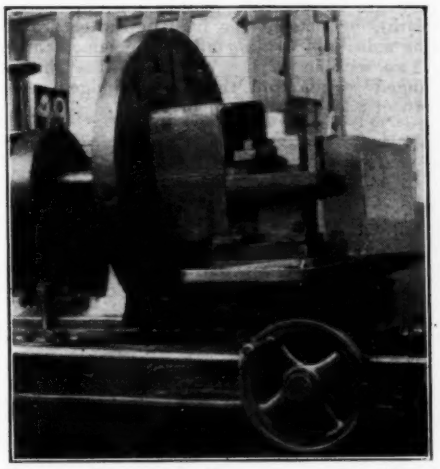

Fig. 3.—Instead of Planing the Box Parts they are Trued-up on a Converted Milling Machine.

the weld is nicely trimmed up on the outside, the inside is left rough, which is an advantage rather than a disadvantage.

Now that the box has assumed practically its finished shape it is rigged upon a special lathe, really a milling machine, one of which is shown on Fig. 3, which has been specially adapted for the purpose, and is machined on both its upper and lower faces.

Fig. 5.—The Two Chief Sections used in the Making of Pressed Steel Moulding Boxes.

By machining both faces it not only ensures a perfect joint being obtained, but where loose pins are used the boxes can be "piled" for "multiple" pouring, or used as three or more part boxes for deep moulds.

The next step is to drill the holes to a jig on either side of the weld for the purpose of riveting on the handles and lugs. These lugs are sometimes made of cast- and sometimes of malleable-

Fig. 4.—A Template is placed over the Box-parts for Drilling the Lugs.

iron, but as the former wears better, even though it is more fragile, it is to be preferred.

From the moulders' point of view the next step is one which has been discussed times without number in every foundry, viz., the accuracy of drilling the lugs. The method which is used in these works is either to prepare carefully a template of their own or to use one supplied by the ultimate user. This jig is placed over the box, as shown in Fig. 4, and the drill centred by holes prepared in them. Under these circumstances it

will be readily seen that all boxes of the same size must be interchangeable, which is a great advantage, so far that the moulder has not to waste time in sorting out bottoms to fit the tops, which has to be done in many cases where cast-iron or wooden boxes are used. In some cases where it is necessary boxes are made interchangeable, even when they are of different lengths but of the same widths, by placing the lugs in the centre of the long sides and drilling all to the same centres.

Two sections of box are made—the channel or flanged section and the arc or bulged section—both of which are shown in Fig. 5.

Fig. 6.—A Group of Boxes, One Stack of which is for Pouring On-end.

The channel section is generally used for all descriptions of moulding, with the exception of power press moulding machines. For the latter the arc section is more suitable, as it allows the ramming plate of the machine to press the sand evenly in every part of the box, which obviously the channel section will not allow, owing to the ramming plate not being able to ram the sand effectually under the top flange of the box nearest the ramming plate. Of course, both sections are suitable for hand-ram or jar-ram moulding machines, and for floor or bench moulding, though probably the majority of founders prefer the channel section for ordinary hand-moulding.

A great variety of boxes are made. They can be square, rectangular, or round, and may be provided with flat or vertical bars. Some are made with holes at the end of the boxes for pouring on-end, as shown in Fig. 6; others have special iron lips for "Multiple" pouring.

The advantages which are claimed for pressed steel boxes may be summarised as follows:—(1) Strength, associated with lightness; (2) rigidity, due to the flange or bulge; (3) better jointing, as the faces are machined; (4) more durable than wooden or cast-iron boxes; (5) less fragile than cast-iron boxes; (6) greater output, owing to the men being able to do more work and not be needlessly exhausted as when handling heavy cast-iron boxes; (7) equally suitability for all purposes—machine moulding, bench and floor moulding.

A Formula for Making "Fillings."

The March issue of the "Fonderie Moderne" gives the following mixture for making a cement suitable for filling cracks or blowholes:—Wax, 2 parts; flowers of sulphur, 2 parts; finely-powdered slate, 1 part; finely-powdered graphite, 1 part; and cast-iron filings, 5 parts. The wax is melted over a slow fire, the slate is added, and then the graphite mixed with the filings, and finally the sulphur is stirred in.

Another mixture which can be used for dry joints is:—Grey-iron turnings, 10 parts; flowers of sulphur, 1 part; sal-ammoniac, 1 part; and a sufficient quantity of alcohol to make a paste.

MR. R. A. BULL, Research Director of the Electrical Steel Founders' Research Group of Chicago, U.S.A., has been elected a member of the Institute of British Foundrymen. Mr. Bull is also a member of the Iron and Steel Institute, and was President of the American Foundrymen's Association in 1915 and 1916.

Grey Cast Iron, Malleable Cast Iron or Steel.

By Neville Deane.

The question as to which of these three materials to use is one which engineers are often called upon to solve in the designing of new plant. Obviously, the answer is whichever of the three will perform the work required at the lowest cost, so that it is necessary to know for what purpose each material is most suitable.

Grey Iron

There are some uses which are almost exclusive to certain materials; others depend upon special circumstances. Grey iron castings are suitable for any parts subjected to a crushing strain, but not for parts intended to withstand twisting, bending, or shearing stresses. In fact, grey iron is for rigid structures, except under special conditions—*e.g.*, piston rings. Such parts as furnace plates, engine bed-plates, columns, cylinders, pipes for gas and water, etc., are usually made of ordinary grey iron with success.

Malleable Iron.

Malleable cast iron is, of course, more expensive than grey iron, but, by way of compensation, sections may be made much lighter by reason of the increased strength, which is often more economical. Malleable castings are excellent for small to medium-sized work which is called upon to bear bending or twisting stresses or to withstand shocks. For these reasons it is used, almost to the exclusion of other materials, for various parts of motors, cycles, agricultural machinery, railway work, keys, and a host of similar small parts. It is easily machined, can be cast into most intricate shapes of thick or thin sections, has a clean surface, can be bent in the cold if fairly thin, and has a remarkable power of resisting corrosion. These advantages are applicable to both white and black heart castings, but the former is more suitable for thin sections than thick, whilst the latter is suitable for either thick or thin sections

Steel.

With steel there is a choice between castings and forgings. Where possible the latter are the better, and, in cases where strength is the main consideration, are to be preferred to malleable castings. On the other hand, steel castings are applicable to more complicated jobs where strength, together with ductility, is desired. Steel cannot easily be cast into very thin sections, such as is possible with malleable cast iron, and the surface is usually rougher. There is also a tendency to blowholes and spongy defects unless care is taken. Additionally there is the "drawing" trouble characteristic of all castings. The strength is normally higher than that of malleable cast iron, and in addition the structure is the same throughout, whilst in malleable castings the inner core of the section is vastly different from the outer surface. This is a matter needing consideration if a large amount of machining is to be done.

To sum up, therefore, steel is used where strength and ductility are required more than anything else; malleable cast iron is used where strength and ductility, combined with thin sections and clean-surfaced castings, are needed; and grey cast iron is used where strength in compression, combined with a cast shape, but practically no malleability is required.

Iron and Steel Production in January and February.

The Statistical Bulletin of the National Federation of Iron and Steel Manufacturers for February states that the output of steel ingots and castings in that month totalled 418,800 tons, as against 327,500 tons in January and 381,000 tons in December, 1921. Of the February total 124,900 tons were acid open-hearth (96,200 in January), 241,400 tons basic open-hearth (190,900 in January), 31,400 tons acid Bessemer (27,200 in January), 16,300 tons basic Bessemer (8,800 in January), and 4,800 tons were steel made by other processes (4,400 in January).

The Manufacture of a Monobloc Motor Cylinder Casting.*

By W T. Evans.

There has recently appeared in the foundry Press a series of articles on the above subject, in which were shown methods of production which the author has every reason to believe are contrary to those in use in most British foundries.

It is hoped these articles will bring before foundrymen methods of manufacture which will give much better results in production of patterns, core-boxes, moulds, and also sound castings.

Modern motor cylinders are without doubt some of the most difficult castings which the foundryman has to produce and give the pattern-maker and moulder sufficient to do to obtain sound and accurate castings, which it will be able to machine in jigs without marking out, and therefore correct and true to pattern; also of a material that will tool easily and at the same time give a good ground finish without porosity or failure under water or oil test. It is one of the worst problems the motor trade has to face—the production of large quantities of sound cylinder castings, as to have numbers of these expensive castings scrapped at perhaps the final machine shop operation entails considerable loss, also reduced output. There always will be a percentage of wasters in this class of casting, owing to intricate designs, and the human element, also the smallest particle of slag, sand, or small blow-hole, casting temperature, faulty materials, very often means starting again at Genesis.

Tests to be met.

There are three tests which are generally applied, viz., a water test of 20 to 30 lbs. per sq. in. on the water jacket; a pressure test of about 500 lbs. on the barrels, and sometimes a cubic capacity test, and before long we shall be faced with a material test to a given analysis, and the foundry cannot leave anything to chance to achieve success under these conditions.

There are many motor firms who do not make their own cylinders, and this applies often when having their own grey-iron foundries, from which it would seem that firms are fully aware of the problems to be faced. What is very surprising is that under these conditions buyers will move their cylinder patterns about from foundry to foundry for a very small reduction in price. Very often this does not give the manufacturer a chance to achieve success, as he has no sooner overcome his initial troubles and the moulder and coremaker have become used to the particular difficulties obtaining when the patterns are withdrawn. Only those who are intimately connected with the foundry know how narrow the margin often is between success and failure, and very often it is only after days of thought and search that some small trouble is located and rectified. In all cases the machine shops should advise the foundry at once of any defect, however small, as very often this is easily overcome before any large number of castings are produced.

Difficulties to be overcome.

It is impossible to emphasise too much the quality of the materials used in the casting. With modern machine-shop production conditions, viz., the use of expensive milling cutters, reamers, etc., any hard spots in the castings very soon ruin the tools used. The foregoing remarks will give the reader an insight as to the conditions to be faced and difficulties to be overcome.

The example taken is a four-bore mono-block cylinder with induction pipe cast in the water jacket, and used on a well-known British make of car. Fig. 1 shows this type, which is fairly common.

Pattern making Details.

The initial step to success is a first-class pattern, and those who can carry out this particular work and see a successful casting made without much complaint from the foundry have reason to be proud of their efforts.

* A Paper read before the East Midlands Branch of the Institution of British Foundrymen.

The question as to whether a wood or metal pattern and core-boxes should be made must be left to the individual and the conditions obtaining. In the writer's opinion, if a good, dry, hard wood pattern and coreboxes are made, with metal loose-pieces, prints, etc., it should be able to produce from them some thousands of castings, as with machine moulding on jar rammers, also the use of sea-sand mixtures for the cores, there should not be the wear that obtains under ordinary conditions.

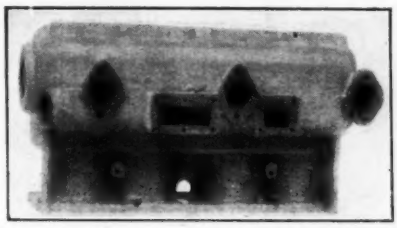

Fig. 1.—A Monobloc Motor Cylinder, the Manufacture of which is Described.

To commence the job, it is necessary to obtain a good, dry drawing-board, preferably of yellow pine, straight-grained, and free from any other defects. If the wood is straight-grained, the scriber used to make the lines of the lay-out will not be inclined to "run" from the straight-edge, which means a more accurate and neat drawing. The cylinder is drawn out full size, the necessary machining allowances being added after, and shown in coloured pencil. Having decided the method of moulding, it is necessary to show the joints of the pattern, also the junctions of the cores, then the outline of the "prints," showing the correct taper, as it is necessary to construct all coreboxes to suit such taper. No rubbing of the cores should be allowed.

With the methods here advocated the foundry can very often use existing moulding boxes, and for this reason the pattern-maker should make sure of the depth of the middle box-part, as it is necessary to make the middle joint of the

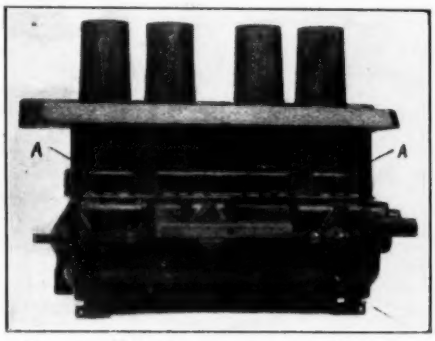

Fig. 2.—The Pattern, which Admits of Two Joints. The Top Part is all Prints, and A A are Inserted Metal Webs.

pattern to suit. The foreman moulder should now decide which boxes he intends to use; also, if a certain output is required, the number of core-boxes necessary for such output, as under normal conditions it is best to construct the duplicate boxes at the same time to ensure interchangeability.

Cutting the Timber.

When these details have been definitely decided the whole of the timber for the job should be cut out, as this will give it time to season still further, as, no matter how dry such timber is, there is always some "running in" after being freshly cut, and this must be avoided if possible. The

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lay-out is here shown with all the necessary lines and sections to construct the pattern and core-boxes, and the setting out of the pattern, etc., should be carried out from the lay-out as far as possible, using the blue prints for checking purposes.

Details of the Pattern

There are two joints in the pattern, the first through the ports, the second behind the flange at the end of the barrels, and it is made for moulding on a jarring machine, and, to facilitate this, the middle part and top part of the pattern are of the same depth. The construction of the pattern is shown in Fig. 2. It will be noticed that the flange at the end of the barrels is not visible. This loose flange is built up and finished *in situ* on the pattern, then removed and fixed in a core-box to facilitate machine moulding. The finishing of the flange as part of the pattern ensures a perfect match of this part, when the core is fixed. This means that the top part of the pattern is all "print," that is, four round prints for the barrel cores, and the large flat print for the flange core. The prints for the barrel cores are made of sufficient depth to come just under the level of the box part when rammed up, thus leaving the corresponding holes through this part of the mould, which enables the moulder to see plainly the barrel cores when lowering on his top part. It is desirable to have plenty of taper in these prints, as when the top part is in place after making provision for "bringing off the air" from the barrel cores, these taper holes can be rammed with sand, which will keep the barrel cores from lifting, and obviate the use of weights, thus giving a clear top part for runner and riser boxes, etc.

It will be understood that the barrel cores will be made with about half the length of "print" to that shown on the pattern. Ample taper in the print must be allowed for the flange core, as this core is fixed on the top of the middle part, and located by the mould, which means that the top part has to be lowered over it, and plenty of taper ensures that this core will not be moved, as it will be clear of its print until the core is almost down, thus avoiding a crush. The middle part of the pattern does not need much explanation. There are the two small bosses which have prints on the underside to facilitate moulding. The two webs shown at "A," Fig. 2, are made of metal, and let into the solid part of the pattern.

All the fillets in the pattern are worked from the solid, and the joints in the wood are so fixed to allow for this feature. The bottom part of the pattern is entirely worked from the solid, with the exception of the prints, which are made in metal, and fixed in position when the whole pattern has been sand-papered up and finished.

Pattern Boards.

The pattern is now mounted on the board for the moulding machine, as shown in Fig. 3. These boards have cast-iron strips bolted across them, which have been planed up to an even thickness. It will be seen that the board is rebated down to take the strip, and this cast-iron strip takes the weight of the mould when being jarred, and is made wide enough for this service, also saving the wooden board from wear. Cast-iron strips are more serviceable than mild steel, owing to the fact that the constant blows from the jarring operations stretches mild steel strips, thus causing same to curl up at the extreme ends, with the result that the box-part will not lie well on the board. These conditions are almost absent when using cast-iron strips.

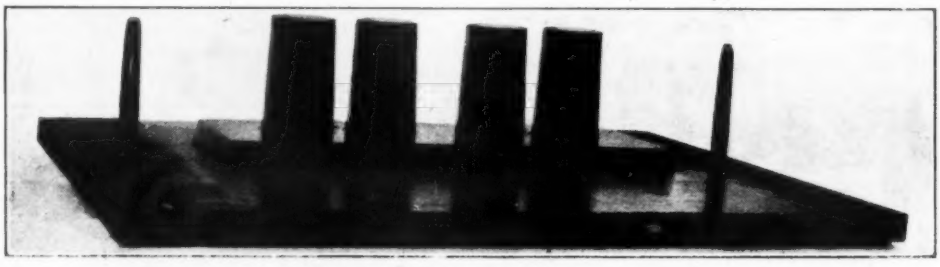


Fig. 3.—The Pattern Board.

This covers most of the pattern. It is as well to make sure that all prints are on the full side, to obviate rubbing of cores, as in most cases prints in a mould, when dried, are a little smaller, and the cores, when blacked, are very often a little larger, and if the pattern-maker will always bear this in mind he will save the foundry much trouble. Also, when once the rubbing of cores is resorted to, it is very rarely one gets two castiugs alike. One of the chief objections to machine-moulding this particular class of casting in the manner here shown is the provision of moulding boxes, and unless special methods are adopted and the quantity ordered is not a considerable number, it will not be a paying proposition to the foundry to make such box parts, as with a three-part mould, each part of which is rammed separately, it is obvious that the joints of boxes must be planed, also that the middle parts must be interchangeable, and all of the same depth.

By constructing the pattern, as shown in Fig. 2, different depths of patterns can be accommodated in the same middle part, as the pattern-maker has only to keep the joint in each particular cylinder of the same depth as the moulding box, which means that the flange-print and core are either thicker or thinner as the case may be, and as it is not necessary to have bars in the cope close to the joint there will be ample room for a somewhat thicker print and core, and the writer has seen as many as six patterns of different length moulded in the same boxes. This enables an order for cylinders of small number to be economically machine-moulded.

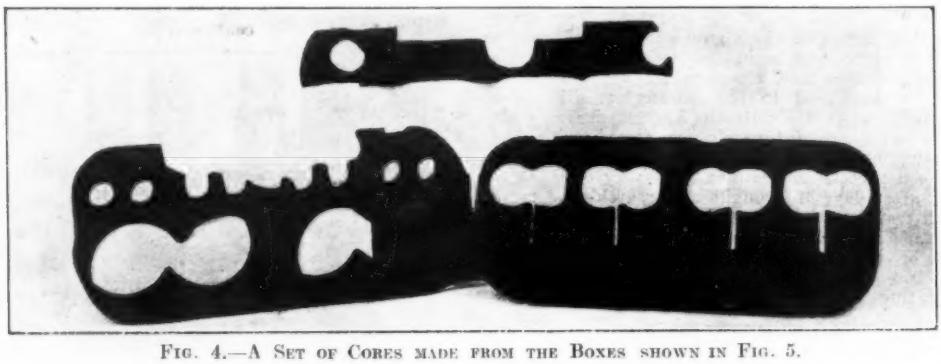


Fig. 4.—A Set of Cores made from the Boxes shown in Fig. 5.

Core Boxes and Cores.

The method of construction of the core boxes will be seen from the illustrations, and they consist of three jacket boxes, top and bottom shell, and a loose piece behind the port holes of the combustion head core, induction pipe, small elbow, boxes for exhaust ports and barrel core box. The latter core-box is made to jar-ram the round barrel core, as this gives a core which is not so liable to scab, etc., as if rammed by hand.

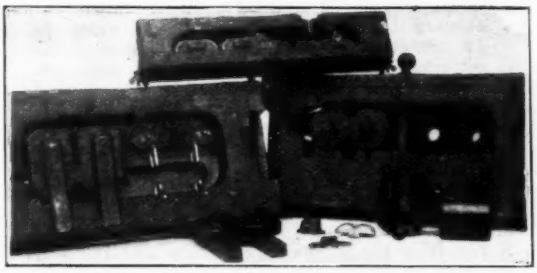


Fig. 5.—A Set of Core-Boxes for making a Monobloc Cylinder.

Fig. 4 shows the complete set of cores, and Fig. 5 a set of core boxes for their making. The Nos. 1, 2 and 3 shell cores form the water jacket round the cylinder barrels, exhaust pipes, etc. Very often there are only two jacket cores, but in this case there is the long thin core shown, which is jointed through the centre of the exhaust elbows to facilitate the fixing in the mould of the elbow cores, and this simplifies the coring-up operations.

It will be seen from Fig. 4 that the core-boxes for the jacket are all framed up, and the inside shape worked from blocks, which have been fitted to the frames. This is by far the best method to adopt for this class of work. The frames are loose, being fastened with bolts and thumbscrews to facilitate the drawing of the cores, to save unnecessary punishment to the core-boxes.

Fig. 6 shows the flange core-box, with the flange taken from the pattern fixed inside, also the runner, or spray, used for casting purposes in front of the core-box is the core from same. To the right of the flange-box is the induction pipe core-box, which is a fairly intricate and difficult core-box to make, and has to be jointed in three pieces. In front of this core-box is the resulting core. This core is made in two pieces, and glued together before being used in the mould. On the right of the pipe core-box are the combustion head boxes, with two cores resulting, one of which shows the dowel which locates the barrel cores. The small core shown in front of the flange core is one of the exhaust cores.

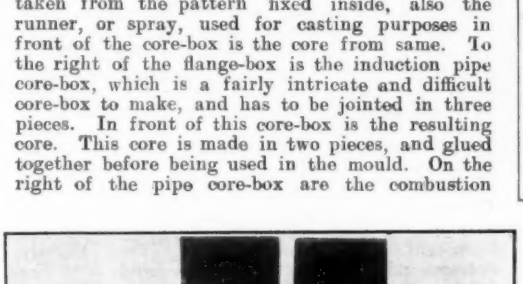


Fig. 8.—Further Details of the Core-Boxes, including the Inside of Barrel Core-Box.

Fig. 7 shows the outside of the induction-pipe core-box, the barrel core-box, and combustion head-boxes. In Fig. 8 are shown further details of the core-boxes, also the inside of the barrel core-box, with the plugs which locate the same on combustion head cores already mentioned. Fig. 9 shows a complete set of cores roughly placed together to illustrate further the loose piece of the shell core, and the flange cores.

Materials used in Cores.

The whole of the cores, except the four barrel cores, are made from a sea-sand mixture. There have been many mixtures of sand for this particular class of core, associated with all kinds of core oils and binders, but after experimenting with a fair number of oils, the author finds that, for cheapness and general utility, there is none better than an equal mixture of linseed oil and molasses.

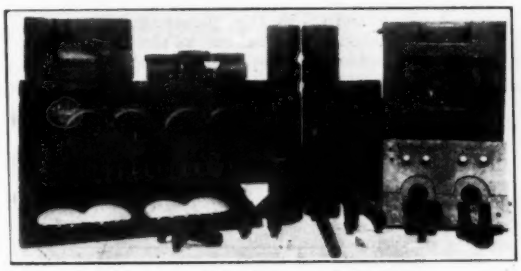


Fig. 6.—The Flange Core-Box.

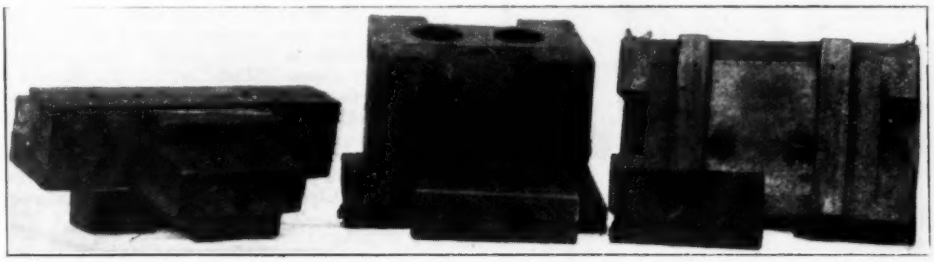


Fig. 7.—The Outside of the Induction Pipe, the Barrel, and the Combustion Head Core Boxes.

Some of the best results have been obtained from a mixture of 50 per cent. sea sand and 50 per cent. red sand, both dried, and then mixed with the required quantity of binder.

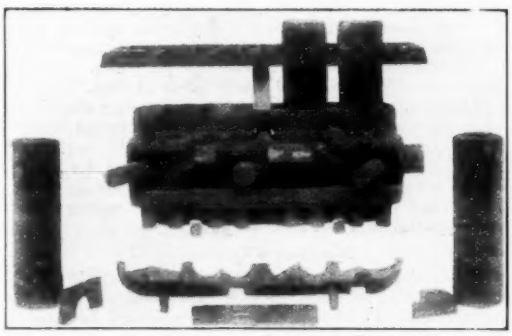


Fig. 9.—A Complete Set of Cores Roughly Assembled.

Cores made from this mixture will require very little packing, and in most cases will hold up green, which means that they will conform to shape much better than those made from sea sand alone.

The worst feature of cores made from ordinary sea sand is the difficulty of handling and mending when green.

Another and most important feature of a mixture of the two sands mentioned is that very few core irons or wires are required, which makes a very considerable saving in core-making and

fettling of castings. Very often the only means of removing sand and core irons from these castings is through small round holes from ¾ in. to 1 in. dia. in the outside of the water jacket, and to withdraw any quantity of core wire throug such holes is very often a tedious job, and a serious loss of time, and a mixture of sand, which overcomes the use of core irons, is necessary for success.

It is interesting to note that the skin on cores made from this mixture has a much finer and smoother appearance than when made entirely from sea sand, thus giving a better finish to the castings.

The barrel cores are usually made from an ordinary core sand, fairly open, and made on a small jar-ram machine, with the plugs for locating these cores in the mould at the bottom. This means that the core is closer and harder at the bottom of the mould than the top, giving every chance for the "air" to get away, also this gives little trouble owing to the "scabbing" of the barrel cores when the metal enters the mould. In fact, this trouble is very rarely seen from a machine-made core, whereas it has often been a source of complaint with cores rammed by hand.

The Moulding Boxes.

Fig. 10 shows a complete set of moulding boxes. The one on the left is the top box or cope, the centre the middle part, and that on the right the bottom, or drag.

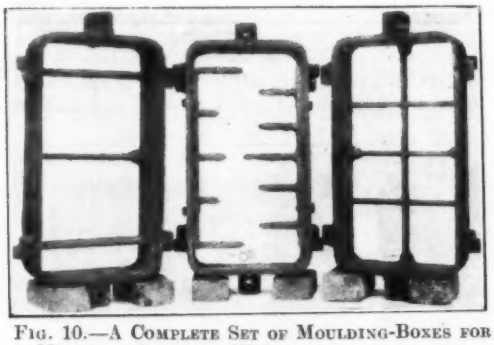


Fig. 10.—A Complete Set of Moulding-Boxes for Monobloc Cylinder Work.

As shown, the bars in the cope are kept well back from the joint to allow for the variation in the flange print. The bars or grids in the middle part are made loose and fastened by two set-pins, otherwise it would not be possible to take the castings from the mould when cast. It will be seen that all corners are radiused, to overcome weakness; as the boxes are used for dry sand moulds, no handles are cast in, but only four snugs, provided with a round hole for handling purposes. This saves considerable stove space when drying.

The snugs for the loose pins are double; that is, cast together in pairs, with brackets between, and when jig-drilled will keep the "pins" vertical when closing the moulds. Another good feature of the loose bars shown is that it is a simple matter to change these to suit the different contours of other patterns when necessary.

Moulding a Casting

From the illustrations it will be observed that the moulding of this casting has been simplified by the use of cores in order to facilitate production on the machine, and this practice has become general. Very often patterns are made with pieces below the joint, which have to be jointed down to, whereas a print and core will save time and risk, and the pattern-maker should always adopt this practice and save the moulder unnecessary jointing, as solid patterns which could be made easily in halves, but deep "lifts" hanging to the cope of a mould are a fruitful source of complaint, and a serious loss of output results.

(To be continued.)

Alfred Herbert, Limited, have closed their New York offices, and Mr. E. D. Mitchell, who has hitherto been in charge, will return to this country on April 19. The Vandyck-Churchill Company, 149, Broadway, New York, will in future have charge of Messrs Herbert's interests in the United States

German Foundry Practice.

Dr. Richard Moldenke was the guest at a recent meeting of the New England Foundrymen's Association. The subject of his address was "Recent Developments in European Foundry Practice."

Most of the new developments, of which he spoke, concerned those in Germany, and were the direct result of the war. Certain things were concealed during his inspection of various plants and processes, and since then German interests have not been able to patent their processes in other countries; consequently, Dr. Moldenke was frank to state he was not in a position to explain in detail some of the things he discussed.

For instance, the Germans had discovered a new process for desulphurising cupola iron. The metal is run from the cupola into a ladle and the slag removed. The contents of a package, about the size of a cigarette box, are then thrown into the ladle, which the metal absorbs in about two and one-half minutes. The original sulphur content of the iron is reduced about one-half if the slag is removed. The contents of the package are in powdered form. Dr. Moldenke said it might be potash, or possibly potash plus some ferro-alloy. Whatever it is, it is cheap, and affords a method of securing better castings in this country by the small foundry owner who cannot afford an electric furnace, or the expense of large percentage pig-iron cupola charges, the two other methods of reducing sulphur.

In Dr. Moldenke's opinion the Germans have not progressed as far as the Americans have with the electric furnace. Great progress has been made in Germany, however, in methods of handling moulding sands. By regrinding, etc., they are able to use such sands many times, and, in so doing, produce finer castings than they did before the war. He also touched on a new type of gas producer used in steel mills. This producer is practically a small blast furnace, 10 ft. high and 7 ft. in diameter. These producers are charged with coke and 2-lb. air pressure is supplied by centrifugal blowers. No steam is employed. Each charge produces, besides gas and slag, a small amount of 12 per cent. manganese pig-iron, which, it is claimed, pays for the cost of operation of the gas producer.—"Iron Age" Report.

Steel Additions to Pig-Iron, and Inverse Chills.*

The author assumes that necessary conditions for the occurrence of white spots, the result of inverse chill, are low carbon and silicon content, with high sulphur and low manganese. The use of rusty scrap and a low casting temperature also induce favourable conditions. Basing his investigations on this assumption, he gives explanations and illustrations, mainly chemical, of how these conditions operate to bring about the phenomenon, and discusses the effects, from this point of view, of the steel addition to the pig-iron. Detailed experiments were made with additions of 5, 20, and 40 per cent. of steel, having the percentage composition, C, 0.1; Mn, 0.45; P, 0.05; S, 0.04-0.05; Si, 0.12. Rods, 20 mm. (0.79 in.) dia. and 450 mm. (17.72 in.) in length, were cast for testing. Compared with similar rods, but without the steel additions, the analysis of the 5-per-cent. steel showed a change from slightly over-eutectic to slightly under-eutectic. The fracture was grey and somewhat matte. With an addition of 20 per cent. of steel the fracture was still grey, but exhibited the appearance of typical burned iron, with an increased content of sulphur and phosphorus. With 40 per cent. of steel numerous white places appeared in the fracture. The influence of the slightly greater rapidity of cooling in the upper portion of the rod is shown in the notable increase of white places. Tests for sulphur showed the correspondence of the increase of sulphur and phosphorus with the white portions.—E. Piwowarsky. (*Giess. Zeit.*, 18, 356 359.)

* Institution of Civil Engineers Abstract.

The Blast Furnace and the Foundry Cupola.*

By J. E. Fletcher, M.I.Mech.E., M Inst.Met., Director of Research, British Cast Iron Research Association.

(*Continued from page 247.*)

APPENDIX.

In the example mentioned on page 231, col. 1, it may be useful to give data on which the author's reasoning is based.

The cold air supplied by the blower was at the rate of about 24 cub. ft. per sec. per tuyere, each tuyere having 0.10 sq. ft. area. At 650 deg. C. the cub. ft. of air delivered to the furnace per sec. would be nearly 72 cub. ft. per sec., and at 455 deg. C. 57 cub. ft. per sec. per tuyere. The theoretical kinetic energy possessed by the 650 deg. C. air would be 1.26 times that of the 455 deg. C. air, and if blown into an open space would have a penetration effect in direct proportion to the kinetic energy possessed by the jet as it emerges from the tuyere nose. The cylinder or column of air projected from the tuyere meets resistance in the coke, etc., in the hearth and collapses, much as a soft-metal long-projectile would collapse when fired against a plate. The higher the velocity of the less-dense air-cylinder, the more will the crippling effect be emphasised. In the case under consideration the two columnar or cylindrical projectiles of air discharged from the mouth of the tuyere may be visualised as 4.25 in. dia. and 11.4 in. and 14.4 in. long for the 455 deg. C. and 650 deg. C. columns respectively. It is reasonable to consider the cohesion between the air particles to be greatest with the denser air, hence it is a logical conclusion that the lighter air column travelling at the greater velocity will more readily break up when it meets obstruction than will the lower velocity denser column.

Again, the air column as it progresses traverses increasingly higher temperature zones, and it is clear that the hotter blast column will become more expanded in diameter as a consequence, and hence lose its velocity and penetration effect. The penetration effect value, as deduced from the kinetic energy factor of the air as it leaves the tuyere, must therefore be modified. It is not known quantitatively what this modifying coefficient of penetration is, but from practical observation the spreading or breaking up of the air column under the conditions of resistance to the impact of hot rarified air points to the probability of a hot-ring zone being formed, narrower and hotter in the case of the hot-blast than in that of the cooler blast supply, the weight of air entering per minute being constant in each case.

The greater the variation between the peak and trough of the temperature change curve the more variable will be the effect. There will be a condition when the air velocity, as related to the diameter of the hearth, will be unaffected by the usual variations in air blast temperatures, in the case of hearths of large diameters.

In the smaller furnaces working on foundry irons the effect as described tends to variations of product. The make per minute must obviously be greatest when the hotter air is being supplied.

The furnace in question was using about 870 lbs. of cold air (at 15 deg. C.) per min., and burning normally about 140 lbs. of coke. The difference in the heat supplied per minute at 650 deg. and 455 deg. C. would be:—

$$350 \times 0.25 \times 870 = 76{,}000 \text{ B.T.U.}$$

Taking 1,850 B.T.U. per lb. of iron smelted (Campbell), it will be found that when the 650 deg. C. air is being used the rate of smelting will be about 40 lbs. per minute greater than when 455 deg. C. air is employed.

Further, the author has before pointed out that a difference in the hot blast temperature of 17 deg. C. may be responsible for a 0.10 per cent. rise or fall in the silicon content.*

Hence the 195 deg. range in temperature in the case cited may mean a 1.0 per cent. difference in silicon content during the interval between stove changes. Brassert has referred to this effect when discussing regularity of blast furnace operations in the U.S.A. In this connection Gontermann, in his investigations on the equilibria of composition in C. Fe, Si alloys showed that silicon requires much less carbon when the temperatures are high—a 3 per cent. silicon alloy demanding 0.5 per cent. carbon at 1,450 deg. C., and 2.75 per cent. carbon at 1,250 deg. C. The deduction from these results is that during high temperature hearth actions the carbon expelled by the silicon in its alloying with the iron to form iron silicide is taken up by the adjacent iron, tending to the production of hyper-eutectic iron. That such is the case is illustrated in the analyses of foundry irons in Table 1 (page 230).

Gottermanns Research.

Gontermann's research, shown in Fig. 1, indicate that when a 3 per cent. silicon iron is being made in a furnace whose temperature is, say, 1,500 deg. C., the silicon-iron equilibrium requires no carbon. Suppose the metal in the hearth to be primarily of 4.3 per cent. carbon content before silicon reduction takes place. The effect of the silicon alloying (3 per cent.) will be to reduce the mean carbon content, the metal being now a mixture of 15 per cent. of Fe_2Si and 85 per cent. of carburised iron containing primarily 4.3 per cent. carbon, the mean carbon content of the metal

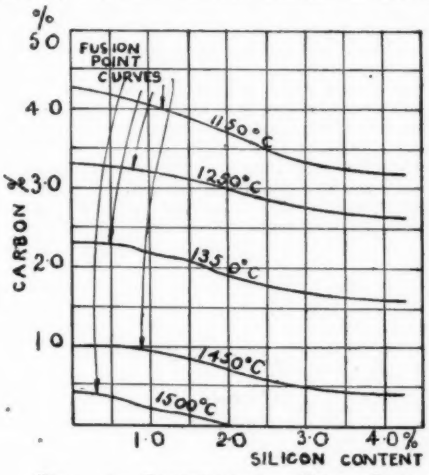


FIG. 1.—GONTERMANN'S CARBON-SILICON DIAGRAM.

being 3.44 per cent. But as the hearth temperature is higher than that of eutectic equilibrium, and the hearth rich in carbon, the tendency is for the eutectic to become further carburised towards the equilibrium connected with 1,500 deg. C., viz., the 5 per cent. C.-Fe alloy (Hanemann). Thus the maximum or saturation carbon content for the metal is 4.25 per cent. (0.85 × 5). This reasoning gives the visualisation of the action of high-carbon metal simultaneously with that of the alloying with silicon, in the production of grey iron.

Contact Carburisation.

In practice, though the hearth temperature above the slag may be 1,500 deg. C., that of the actual hearth-metal may not exceed, say, 1,400 deg. C., at which temperature the metal would be tapped. Such metal would be hyper-eutectic and be saturated at a carbon content of, say, 4.0 per cent. In such a case when, in addition to 3 per cent. Si there is 1.5 per cent. P in the iron made, the carbon content would be lowered as already shown. Here the maximum possible carbon content would be for 1,500 deg. C. metal, 3.75 per cent., and for 1,400 deg. C. metal 3.6 per cent. The last result is often attained in practice, and indicates high hearth-temperatures. The researches of Charpy, Saniter and Giolitti have shown that at temperatures of 1,000 deg. C. and upwards iron in moderately fine state of

* "Blast Furnace Working and the Function of Slags," Staffordshire Iron and Steel Institute, 1916.

XUM

division can be carburised in contact with solid carbon, coal gas, carbon monoxide and cyanogen until the eutectic composition (4.3 per cent. carbon) is reached.

In charcoal Mr. Saniter obtained a cementation of 3.0 per cent. carbon in 21 hours at 900 deg. C. Charpy and Grevet, by coal gas at 1,000 deg. C., cementated iron at the rate of 0.13 per cent. C. per hour, and in carbonic oxide CO at the same temperature at the rate of 0.25 per cent. C. per hour.

In another experiment pure iron was cemented to 4.3 per cent. carbon by an atmosphere of cyanogen gas at 990 deg. C. in 2 hours.

Cold Blast gives Hypo-eutectic Irons.

As a deduction from the above and the later researches of Giolitti, it is evident that during the period of contact between the blast furnace burden and the carbon and carburising gases, the temperature and atmospheric (gas) conditions are suitable for carburising the descending spongy iron to the eutectic point. It does, indeed, seem likely, from the rapidity in which molten steel absorbs carbon when added to the ladle (Darby method), that the speed of carbon absorption in the fusion zone of the blast furnace is very rapid, especially when CO_2 is absent, and an atmosphere of CO, with solid carbon in addition, can act on the reduced iron and on the liquid iron in the hearth. In cold-blast and cool-blast furnaces (where the air supplied is often in excess of the requirements to burn the carbon in the hearth to CO) there is the probability of the presence of CO_2 with the CO, in which case the rapidity of the cementing or carburising action is affected. This, with the lower fusion zone temperature and the shallow depth of this zone, must tend towards hypo-eutectic iron, such as is usual in the case of cold-blast irons.

Referring to Table 2, the time occupied by the burden in traversing the hot zone of carburisation and melting is approximately, in furnaces A, B and C, 10 hours, 7½ hours and 7 hours respectively—sufficiently long for the carburisation to approach the eutectic requirements.

Clements, in his comprehensive Paper on "British Blast Furnace Practice,"* gives a temperature curve for a modern hot-blast furnace wherein the temperatures from the bottom of the reduction zone to the tuyere level rise from 1,100 deg. C. to 2,100 deg. C. Under such high temperature conditions, the rate of carburisation must be rapid and the tendency to produce hyper-eutectic iron undoubtedly strong.

The author does not, therefore, doubt the correctness of his earlier statement that the natural product of the blast furnace, in a fundamental sense, is the 4.3 per cent. carbon eutectic, though this may become hypo- or hyper-eutectic in the case of cold- and hot-blast furnace practice.

Prizes Offered for Foundry Devices.

In October, 1920, a gift of $1,000 to the American Foundrymen's Association was made by the S. Obermayer Co., the interest on which is to be awarded for devices which will aid foundries in their work. The devices for this year, in the shape of models or drawings, will be on exhibition at the annual convention of the association in Rochester, N.Y., during the week of June 5.

The contest is limited to foremen or other workers in foundries or in other departments of plants operated in connection with foundries. The jig or other equipment entered in the contest shall not be patentable, but shall be such a device as can be constructed in any foundry and used in the production of castings, or in core making, moulding, pouring or handling operations.—"Iron Age."

Altogether 14 boats were put into the water on the Clyde during March, including 6 small motor craft. Of the total measurement of 26,909 tons, considerably more than half is accounted for by two motor liners. For the first quarter of the year the launches number 30, with a measurement of 104,956 tons in all. This shows a decrease of over 40,000 tons compared with the corresponding period of last year.

* Iron and Steel Institute, 1920, v. I.

Can Foundry Conditions be Improved

By F. C. Edwards.

Although it cannot be denied that foundry conditions, in common with those of other branches of engineering and workshops generally, have been vastly improved during recent years—thanks largely to the general development of the hygienic sense—the foundry, considered as a place in which to spend the greater part of one's working hours, is still notoriously unattractive. Naturally, foundry materials and operations effectually bar any approach to, say, drafting-room neatness. One may quite safely asert, however, that out of the 3,000 foundries in England, to-day it would be difficult to find 30 in which combined and persistent effort on the part of employer, manager, and workmen would not effect material improvements beneficial to all parties concerned.

That there is a pressing need for the amelioration of foundry conditions is clearly indicated by the increasing difficulty of obtaining suitable apprentices. There is the significant fact that most of the boys who actually commence in the foundry soon manifest an eagerness to be transferred to another department. The more promising the youth, the more certain it is that his opinion of the foundry, after a few weeks—or perhaps days—may be summed up in the words of R. L. Stevenson, referring to somewhere else, that "it is a very good place to leave."

Now although foundry work must, of necessity, ever possess certain features that the sensitive individual will not find congenial, this is no argument against combatting all removable evils. These are by no means so negligible as is commonly supposed.

Since the absence of natural light and sunshine is the most prolific cause of depression and ill-health, a foundry with blackened windows and grimy walls—which absorb light instead of reflecting it—cannot fail to be dismal, if not actually noxious. Such conditions must, in fact, constantly exert a dispiriting influence upon the operatives. In addition, there are immediate economic consequences: (1) through the direct connection which exists between the conditions of production and the quality of the work produced; (2) the needless expense of artificial lighting. The remedy is obvious: all windows should be kept clean and the walls periodically whitewashed. That the operation, to be really effective, must be frequently repeated, is the strongest argument in its favour.

The problem of maintaining an orderly foundry floor is not so easily solved. Moreover, the difficulty increases with the size and variety of work dealt with. Since orderliness, however, is the universal mainstay of efficiency, the problem should be tackled; a part solution is better than no attempt. This is clearly the domain of shop manager and workmen—of the former especially. The well-known saying, that "order is sanity; disorder, insanity," applies here with particular force. A well-kept foundry may be regarded as the reflex of a methodical type of mind on the part of the individual in charge. Orderly habits are infectious. If the manager is continually striving for general tidiness the rank and file will to a large extent follow. Moulding boxes and tackle not in use ought not to be allowed to encumber the shop. Some firms have rough sheds erected in the foundry yard for housing the smaller boxes when not in service. Patterns should be returned to the stores as soon as possible after they have been moulded off; this not only tends to foundry order, but obviates possible risk of injury to the patterns. Many an expensive pattern has come to an untimely end through sheer culpable negligence in this respect. All gangways should be kept clear. Lack of attention to this point is a fruitful cause of delay, and is a potential source of accidents.

With a little persistent attention to the above and similar matters, there is no reason why the foundry should not approximate, at least during part of the day, to the spick-and-span appearance of the ordinary engineering shop. Moreover, this improved appearance would be more likely to secure and retain the better type of apprentice, who now invariably steers clear of such gloomy surroundings. In turn, his influence would tend to further improve, brighten, and heighten the status of the foundry.

The Mass Production of Motor Pistons and Piston Ring Pots.

By Ben Hird.

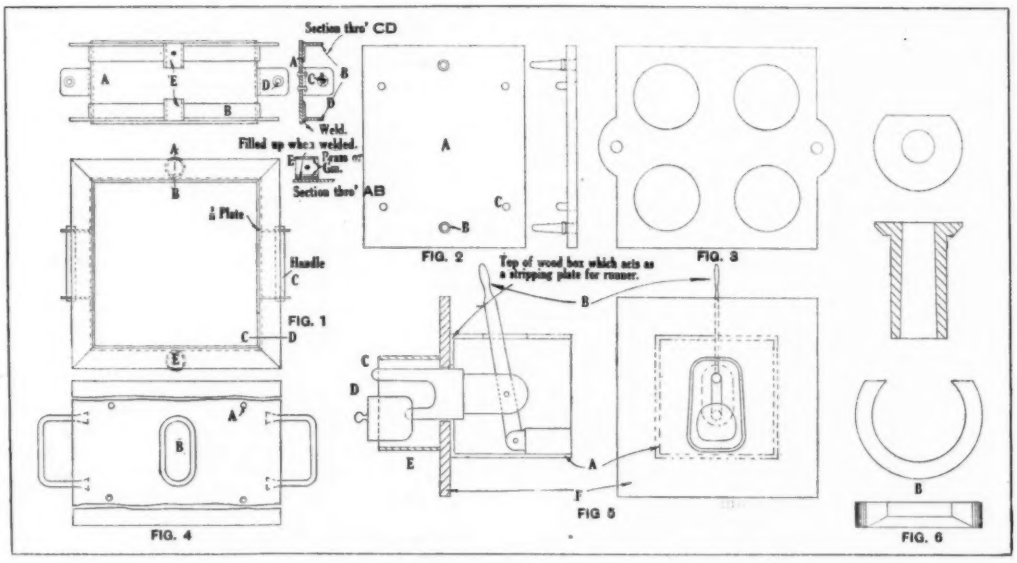
The object of this article is to describe methods which were used successfully by the writer during the motor boom. The foundry being a new department, it was decided to make the moulding boxes in the oxy-acetylene welding shop. The required quantities of the various sizes and depths were made to the design shown in Fig. 1. A quantity of the 3-16 in. plates A, after shearing, were clamped together and planed true on the top and bottom edges. The angle-irons B were cut to the correct bevel with a power hack saw. The parts were then assembled on a special jig and the corners welded. The angle-irons were set back 3-16 in. from the top and bottom edges to give clearance. For the large-sized boxes, which required two men to lift them off the moulding machines and to turn over when full of sand, the pipe handles C were left out, and a long piece of pipe or bar inserted through the holes in the lugs D and removed after the mould was placed on the floor. The boxes were designed to be used for general, as well as special jobs. The pieces were run up with pipe E were welded into the angle-iron as shown in section in Fig. I. These were run up with

Motor Pistons.

The pistons were mainly for motor cars and lorries. Those over 3½ in. dia. were made on No. 1 jar ram "Britannia" machines, and below this size on hand-rammed "Adaptable" machines. For large orders iron patterns were made, but small orders were completed from hard-wood patterns.

Four patterns were mounted, one at each corner, on square iron pattern plates, machined all over. By turning a slight taper on the patterns, no stripping plate was required on the "Adaptable" machines. With the deeper patterns used on the jar ramming machines it was found necessary to use a stripping-plate in order to avoid occasional bad lifts caused by the grip of the patterns on the centrepiece of sand, through the tight ramming of the jolt.

A simple stripping plate, shown in Fig. 3, proved quite effective in overcoming this. The four holes were turned out to the full diameter of the coreprints and the patterns were mounted on round plates of the same thickness as the stripping plate. As the patterns were all made with the usual tapered core-prints to support the cores, it was obvious that the top box was only needed to prevent the cores lifting and provide a cup for pouring. To economise time and labour ramming-up the tops, a number of flat plates, Fig. 4, were made and machined on one side. The four holes shown at A were cast in for the vents,



brass on a special jig plate shown in Fig. 2, where A is a cast-iron plate machined on one side and drilled to suit pins B and locating studs C, which are relative to the centres of the pipes E, and the inside edges of the boxes respectively.

The running in the brass bushes is as follows: Three sets of loose pins B are made, having a slight taper from the collar to the top; the collar should be ⅛ in. thick and 1½ in. dia. It is necessary to make a number of washers of the same diameter out of 1-16 in. thick asbestos, so that they fit over the pins. Two or three ¼ in. holes are then drilled in the pieces of pipe E before welding them into the box, to prevent the brass bushes from falling out during use. The bush pins are smeared with oil and plumbago after putting on the asbestos washers. They are then put in position in the jig plate. The box is then placed on, locating its position by studs C, and weighted down to make close contact on the asbestos washers. The ¼ in. holes are covered with paper and are backed up with clay to prevent the brass running out when pouring. The pouring should be effected close to the furnaces, using a small 1 lb. or 2 lb. experimental crucible as a ladle for the purpose of dipping into the crucible on the fire. After pouring, the box is lifted off and the pins knocked out with a brass hammer. The boxes will be interchangeable, and the holes being in brass will not rust. Additionally, by having the pin holes both top and bottom, the boxes can be used for as many joints as a job requires by using loose or fixed pins as desired.

the oval hole B is for the runner-cup, which is of special design to act as a skimming gate, and to allow any air bubbles carried in during pouring to escape. A cheap drawing arrangement (Fig. 5) was designed for the making of the runner-cups, all work being done by unskilled labour. On reference to Fig. 5 it will be seen that A is a square wooden box about 9 in. × 9 in. × 12 in. high; B, a lever working in a slot for withdrawing the runner from the cup after ramming; C, the skimming runner; D, the basin block, which is a loose piece; E, the runner cup, and F the cover plate. The coreprints on the cores were made 1-16 in. shallower than the prints on the patterns to prevent any danger of crushing the moulds when the plates are put on. A thin ring of oil and blacking run round about the vent holes at the top of the cores, ensures them against lifting and prevents the metal getting into the vents. The plates were clamped on two opposite corners, with special clamps made to grip under the angle-iron on the box and tighten on the plate with a thumb-screw. These were made in the foundry, a nut being cast in the centre to save drilling and tapping.

Piston Ring Pots.

These were manufactured in a series of sizes, each series having a different sized flangehead for gripping the casting in the chuck on the lathe. The flange shown in Fig. 6 was faced on the top and turned on the edge to ensure a true seating in the chuck. To save these operations in the machine shop the flat-machined plates (Fig. 3)

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and a special ring-chill shown at B, Fig. 6, were used in the foundry. These rings were cast whole, the inside edge turned up to size in the lathe, and afterwards cut to suit the flat on the flange. Cutting out this piece provided a convenient place to put the spray of the runners. The rings and plates were smeared each time they were used to prevent rusting. The moulds were made on a "Britannia" jolt ram turnover machine. Four patterns, mounted one at each corner like the pistons, so that the same plates could be used for both jobs. The runner-cups were made up in the way already described. A hole should be drilled through the pattern-plate in the centre of each ringpost for venting the cores; this is carried out after the mould is rammed up and turned over, but before the patterns are drawn. The holes in the cover-plates must correspond with these vent holes, and it is essential to keep them clear. This method proved very satisfactory and enabled a considerable saving to be made in the machine shop.

Centrally-disposed Cupola Tuyeres.

Some little prominence has recently been given to the possibilities of tuyères placed in the middle of the cupola hearth. In the March issue of the "Canadian Foundryman" Mr. Geo. O. Vair outlines his experience with such a plant at Cleveland, Ohio. Under the late Thomas D. West, Mr. Vair states, he improvised a make-shift tuyère and tried it several times. The brick lining was as clean after dropping the bottom as before lighting the fire, and everything about the whole heat was first class, only that the centre tuyère itself would shell off, and sometimes become bunged.

In the illustration is seen the complete tuyère

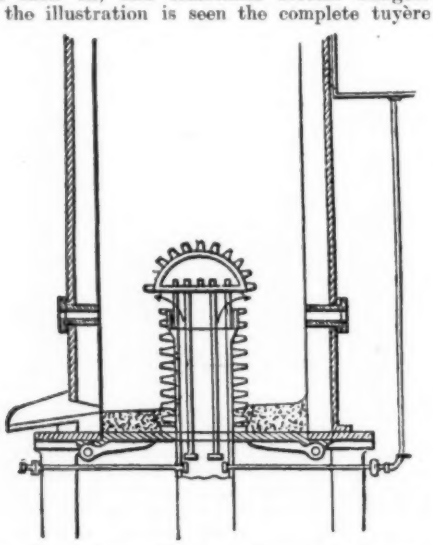

Fig. 1.—Arrangement of a Cupola provided with a Central Tuyere.

as Mr. West had it. As will be observed it passes up through the bottom of the cupola instead of through the sides, and admits the blast to the centre of the cupola at the same level as the side tuyères. It is not designed to change the nature of the iron by forcing the blast through the molten iron in the bottom of the cupola in an attempt to bessemerise it; in fact, the blast has no more effect upon the quality of the iron when admitted in this way, than when admitted through the side tuyères.

A tuyère when placed in the bottom of a cupola, unlike a side tuyère, is brought in direct contact with heated fuel and melted iron, and it must be made of a heat-resisting material, or protected by some such material if made of iron.

The tuyère shown in the illustration is made of cast iron, and is provided with water space between the outside and the inside, through which a stream of water constantly flows when the tuyère is in use, from a small pipe connected with a tank placed alongside the cupola or on the scaffold. It has not been found necessary to keep the tuyère cool with water in short heats, for the heat in a cupola under the tuyère is not sufficiently intense to melt cast iron, and the tuyère may be sufficiently protected against molten iron dropping upon it or coming in contact with it by having a thick daubing of refractory material held in place by the prickers cast on the tuyère. The mouth of the tuyère must be covered to prevent melted iron, slag and fuel from dropping into it in their descent to the bottom of the cupola. This is done with a rounded cap placed on top of the tuyère to throw off the melted iron and slag, and the blast is admitted to the cupola through an opening around the tuyère under the cap, as indicated by the arrows. This tuyère, it must be understood, is movable, so that the workman can get inside of the cupola for repairs, and each time it is used it must be carefully daubed and dried the same as is done with the ladles before being put in place again. If the cupola is large enough to admit a man between the tuyère and the lining of the cupola this will not be necessary.

In the experiments no side tuyères were used, and the brick walls had no slag sticking to them and showed no signs of being burned, but the tuyère would be covered with slag and iron to such an extent that on some occasions it prevented the bottom from properly dropping out. The experiments were not carried far enough to convince Mr. Vair that the centre tuyère was a success, but he still thinks that it is worth looking into. There are so many improved refractories now, to what there were formerly, that there is no reason now why the upright part, instead of being daubed, could not be made of refractory material. The foundry could be provided with moulds in which to make the two parts of the tuyère, or they could arrange to have them made at some place where this was the regular line of work. For comparatively small sizes of cupola, the centre blast could be used by itself while in large sizes the outside tuyères would be the auxiliaries. The centre blast would certainly be a great saving in linings, as it is the blast, more than the fire, that wears out the bricks. The wind pipe should be under the floor and come straight up under the centre of the cupola, and extend to near the top of where the sand bottom would be. Here the tuyère would begin. The bottom would have to be two doors hinged at opposite sides and notched so as to fit around the upright pipe and fall in both directions when dropped. A certain amount of care would be required to prevent the iron from leaking around the upright pipe. If the doors do not fix properly, small plates could be made to the exact fit and rammed into the bottom. It is not at all likely that any saving in fuel would be effected by the use of the centre blast, but there are two features which must be conceded as advantages—it could be made to supply air to the centre of the fire when the diameter of the cupola is too great for the air from the side tuyères to reach, and secondly it could be used in small cupolas without any side tuyères, and be a great saving on the fire-brick lining of the cupola. The blast invariably goes up the brick lining in preference to anywhere else and cuts it away. The tuyère, as shown in the illustration, has all the advantages of a fire-brick one, provided it is covered with proper material and properly burned. This is not an expensive line of experimenting, and might be the means of bringing out some valuable accomplishments.

Industrial Conditions at Essen.

His Majesty's Consul-General at Cologne has forwarded to the Department of Overseas Trade the following report on the industrial conditions obtaining in the steel industry in the Essen district during the last six months of 1921. This has had a fairly steady six months. There have been several local strikes, the most serious being at Bochum, where 12,000 men were on strike for several weeks. Firms still complain that their foreign trade is not as large as was hoped, in spite of the rate of exchange. The shortage of "scrap" is being felt, and some of the larger concerns are negotiating for the purchase of old foreign warships. Wages are continually rising, but, as in the case of the miners, never to a level to be compared with the cost of living.

Trade Talk.

C. A. Vandervell & Company, Limited, are manufacturing machine tools at their Hove works.

The Anglo-Spanish Industrial Association have removed from Amberley House to Lennox House, Norfolk Street, Strand, London, W.C.2.

Anglo-Overseas Engineers & Merchants, Limited, have removed from Amberley House to Lennox House, Norfolk Street, Strand, London, W.C.2.

F. W. Brackett & Company, Limited, Hythe Bridge Ironworks, Colchester, have been appointed buying agents for a large group of mines in South America.

The men engaged at the boiler shops of the Ebbw Vale Steel, Iron and Coal Company, Limited, have received one week's notice to terminate their services.

The Merchant Trading Company, Limited, 275, Gresham House, Old Broad Street, London, E.C.2, have removed to Threadneedle House, 34, Bishopsgate, London, E.C.2.

Before the Sheffield Association of Metallurgists and Metallurgical Chemists on March 28, Mr. F. W. Kayser delivered a lecture on "Cobalt Steels." The meeting was presided over by Dr. T. Baker.

Nasmyth, Wilson & Company, Limited, Patricroft, near Manchester, have secured the contract for six 2-8-0 type locomotives for the Gold Coast Railways, and two 4-5-0 type engines for the Mysore State Railways.

The imports of foreign iron ore at the Senhouse dock at Maryport for the first quarter of the year ended March 31 have been 9,300 tons, compared with 3,700 tons for the previous quarter, and 21,500 tons at the corresponding period of last year.

Mr. J. Shally (late of Shally & Company), importer of straw ropes and wood wool ropes, Linnaeus Street, Hull, has been appointed sole agent for England, Scotland and Wales for the "Wilhelmina" Works, Limited, Someren, Holland.

Licences to manufacture railway and tramway tyres under the Sandberg sorbitic steel process have been granted to Taylor Bros. & Company, Limited, the Monkbridge Iron & Steel Company, Limited, Cammell, Laird & Company, Limited, and Henry Bessemer & Company, Limited.

It was stated at the annual meeting of Hadfields, Limited, at Sheffield, recently, that in the case of Harper, Sons and Bean, Limited, in which Hadfields have a large interest, the receiver was discharged on April 4, and that the new board would include three of Hadfields' directors.

In the official returns of Indian imports for the nine months to December 31, 1921, under the heading "Cast Pipes and Fittings," there was a total increase from 68 to 76 lakhs. British supplies advanced from 49 to 54, American from 19 to 21, and those from other countries from 0.59 to 1.37 lakh.

Three vessels of 10,794 tons, gross register, were launched from the Wear shipyards during last month, compared with only one vessel of 4,700 gross tons in March last year. In all, ten vessels, aggregating 45,379 gross tons, have been put off the stocks on the river this year, against seven vessels and 24,160 tons in the corresponding period of 1921.

The Hendy Hematite Iron Ore Company, Limited, are reported to have struck ore at Pontyclun, near the Great Western and Taff Vale Railways, where prospecting has been going on for upwards of two and a half years. The construction of a short length of tramroad will be proceeded with immediately to connect the outlet of the mine with the railway sidings.

Considerable progress has been made with the preparatory arrangements in regard to the electrification of the Dowlais steelworks and collieries of Guest, Keen & Nettlefolds, Limited. Alban Richards & Company, Limited, the contractors, are engaged upon the erection of the power-house buildings, and Babcock & Wilcox, Limited, are installing the necessary boiler plant.

H.M. Trade Commissioner at Winnipeg (Mr. L. B. Beale) reports that a Western Canadian company are desirous of securing quotations from the United Kingdom for the supply of black iron pipes of the highest grade, in sizes ½ in., ¾ in. and 1 in. suitable for air brake connections on electric street cars. Particulars, the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

J. G. Kincaid & Company, Limited, have closed their Arthur Street Engineering Works, Greenock, and will now carry on operations only in their shops in East Hamilton Street. The Arthur Street works were formerly those of Caird & Company, Limited, and were taken over by Kincaid & Company shortly after Caird & Company's shipyard was acquired by Harland & Wolff, Limited, of Belfast. They have been in existence for over a century.

Sir Philip Lloyd-Greame, Parliamentary Secretary, Department of Overseas Trade, and a large company, which included the High Commissioners for the Dominions, Agents-General, and members of the executive council of the British Empire Exhibition, 1924, went down to Wembley Park recently to see, on the site of the Sports Arena, a demonstration of the work done by a large excavator, which lifts 4 tons at one sweep of its 60-ft. boom. The excavator is of the well-known "Bucyrus" type.

In consequence of the retirement of Sir Alfred Yarrow, Bart., who has been the chairman of Yarrow & Company, Limited, for many years (he is now over 80 years of age), the company is being voluntarily wound up, and a new company is being formed immediately, with Mr. Harold Yarrow, C.B.E., as chairman, while Mr. W. W. Marriner and Mr. S. T. Crush, directors of the original company, will become directors of the new company. Though retiring from the chairmanship, Sir Alfred Yarrow will continue to take an interest in the company, which will have the benefit of his experience and advice.

The third meeting of the newly-formed West Yorkshire Metallurgical Society, held at the Leeds City Museum Library, on April 1, was devoted to papers concerning the electric melting of metals. Mr. F. Rowlinson (Huddersfield) read one on "The Present and Future Scope of the Electric Furnace in the Manufacture of Tool Steel"; Mr. H. P. Abel, Mr. A. A. Liardet, and Mr. W. West, of Bradford, combined in giving a paper on "The Single-Phase Electrical Furnace"; and Mr. F. Kilburn and Mr. H. C. Dews, of Huddersfield, joined in a paper on "The Manufacture of Non-Ferrous Alloys in the Electric Furnace."

In the sixty-seventh annual report of the Manchester Steam Users' Association the committee strongly emphasise the importance of adequate examination of boilers by pointing out that "during the whole course of the Association's existence no preventible explosion has ever occurred of any boiler which the Association has inspected and guaranteed as safe." They add that the imperative need of regular inspection cannot be too strongly urged "in these days of increasingly large units and high pressures." Mr. H. Lee, presiding at the annual meeting of the members in Manchester, on Friday last, stated that thorough and regular inspection, such as was given by the Association, was absolutely necessary in the interests of safety, which should be the first consideration of all steam users.

The annual report issued by the Central Ironmoulders' Association shows that the membership of the association, which at the end of 1920 was 6,912, had fallen to 6,577, a decrease for the year of 335. The balance on hand at the end of 1920 was £19,282, while at the end of 1921 it was £8,008, a decrease of £11,274. Both the income and expenditure for the year, £43,677, were the largest in the history of the association, the former including repayments from State of £18,801 and £16,040 as contributions from members, and the latter, £19,192 for trade unemployment benefit and £18,880 as State unemployment benefit. On the special unemployed fund there was a debit balance of £1,088.

Electric Steel.—In a Paper on "The Present Status of Electric Furnaces in Steel Making," read by Mr. H. Etchells, B.A., before the West of Scotland Iron and Steel Institute, and published in the "Journal" of the Institute, the author remarked that opinion was unanimous that properly-made electric steel gave shock-resistance tests, as exemplified by the Izod test, which were never approached by other classes of steel. Taking the same chemical composition of open-hearth and electric steels, the treatment being the same, the electric steel would give a better elongation, while its tensile strength remained about the same. In steel made for castings, these features came out remarkably well. Test-bars cut from a casting of basic open-hearth steel, C 0.25, Si 0.23, S 0.038, P 0.019, and Mn 0.63, without heat treatment, gave yield point, 15 tons; max. stress, 31 tons; elongation on 2 in., 16 per cent.; reduction of area, 57 per cent. A comparable acid open-hearth steel of C 0.27, Si 0.27, S 0.04, P 0.029, Mn 0.57 gave yield point, 16 tons; max. stress, 31 tons; elongation, 13.5 per cent. on 2 in.; reduction of area, 53 per cent. A representative electric steel of C 0.24, Si 0.25, S 0.015, P 0.02, Mn 0.80 would give under the same conditions yield point, 18 tons; max. stress, 32 tons; elongation, 24 per cent. on 2 in.; reduction of area, 45 per cent. A plain carbon steel, C 0.35, gave on the rolled bar, without subsequent heat treatment, yield point, 33 tons; max. stress, 43.5; elongation, 24 per cent. on 2 in.; reduction of area, 53.6; with an Izod test of 57 ft.-lbs. In working an electric furnace the slag should be kept as basic as possible, consistent with fluidity, and should never be allowed to become silicious. A good analysis was: CaO, 45 per cent.; SiO_2, 10 per cent.; MnO, 7.00 per cent.; FeO, 28 per cent.; Fe_2O_3, 6 per cent.; P_2O_5, 1.50 per cent. A good finishing slag might contain 65 to 80 per cent. combined lime and magnesia, 15 to 25 per cent. silica, 4 to 6 per cent. alumina, traces only of manganese and iron oxides, and over 1 per cent. of sulphur.

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IRON AND STEEL MARKETS.

Pig-iron.

The near approach of Easter and the prolongation of the engineers' lock-out has further restricted the volume of business passing in pig-iron, home trade requirements now being more than fully met by the limited number of furnaces in blast. Pig-iron stocks in hand, however, are rapidly diminishing, especially as concerns best qualities, and even the lower grades of the metal in holders' hands are on an attenuated scale. South Staffordshire smelters, for example, are practically off the market at present, and with a curtailed demand are apparently content to allow their plants to stand idle in preference to incurring loss in production. All the local blast-furnaces remain out of blast for this reason, consumers in the district depending mostly on Derbyshire and Northamptonshire brands, the quotations for which are unchanged from last week's prices. In the West of Scotland very little home trade is doing in pig-iron, but fair shipments are going abroad, exports last week amounting to 515 tons, an increase of 300 tons on the previous week. There were some offers of warrants in Glasgow market for No. 3 Scotch at 98s., and of No. 3 Cleveland at 90s. last week, but no business was done. On Tees-side the market has been adversely affected by the industrial disturbance, and business has been in consequence much quieter than of late. Shipments, however, are still heavy under contracts already fixed, but new export business is not now so brisk. The March shipments of pig-iron from the port of Middlesbrough (including Skinningrove) amounted to 43,001 tons—13,061 tons coastwise and 29,940 tons abroad—as compared with 35,359 tons in February, an increase of 7,642 tons. Of this increase 4,506 tons were due to exports, a feature of which is the growth of trade with Germany, which took 6,380 tons as against 3,136 tons in February. The make of Cleveland iron at present is unusually restricted, and as a consequence the demand for No. 1 considerably exceeds the supply. Still the little that is changing hands is being disposed of at 95s. per ton, whilst No. 3 realises 90s. and No. 4 foundry 87s. 6d., all these being the officially fixed minima. But for No. 4 forge iron the minimum is 82s. 6d., and makers decline to accept less than 85s. per ton, here again a scarcity being reported.

In the East Coast hematite market makers are now keen to sell, and prompt delivery can still be given for orders small or large. This is a significant change, and a fair average price for mixed numbers is now no more than 97s. 6d. per ton. Some makers ask more, but that figure seems to be about a fair market price. There is no change in prices in West Cumberland hematite, Bessemer mixed numbers remaining at 98s. 6d. per ton at works, the figure being one which buyers as well as sellers regard as one that is unalterable in present conditions.

Finished Iron.

Last week's quarterly meeting at Birmingham attracted a better attendance than might have been expected in the prevailing conditions, which have, of course, considerably checked consumption and discouraged the optimistic views so freely expressed of late by a section of the manufacturing trade. Even the recently announced reduction of 27½ per cent. in the wages of finished ironworkers failed to inspire any confidence in the immediate future of the industry, the poor returns of output of the selected firms marking the heavy decline in production as contrasted with normal times. Influenced probably by the result of this ascertainment, the South Staffordshire Marked Bar Makers' Association decided upon an immediate reduction in the price of this material, the official quotation now standing at £13 10s. (net f.o.t. works). Whether this movement will stimulate increased demand for best bars is problematical, but at all events it is a further stage in the process of deflating values which should in time have an encouraging effect upon buyers. Crown and commoner qualities of bar iron are still in limited demand, with prices so far stationary, makers having recently reduced quotations to levels that can hardly carry any margin of profit to producers. The foundry industry just now is experiencing a lean time, the check to engineering activity having had a very adverse effect upon that section of the trade, while the demand for builders' castings affords little encouragement in that direction. It does not seem probable that there can be anything like the pre-war demand for castings this year, and hence even if all the labour troubles are cleared away it is difficult to forecast an early revival of activity in the foundries

Scrap.

Markets for all descriptions of scrap metal are practically without movement, buying continuing quiet in the extreme, consumers, with few exceptions, having more than sufficient stocks on hand to meet the limited requirements of the moment. At Middlesbrough, quotations are unchanged as follows :—Heavy steel scrap, 61s. 6d.; heavy wrought forge iron, 67s. 6d. to 70s.; bushelling scrap, 65s.; ordinary piling iron, 62s. 6d.; heavy cast-iron machinery scrap, 82s. 6d. to 87s. 6d.; ordinary quality, 77s. 6d. to 80s.; steel turnings and cast-iron borings, each 42s. 6d. per ton. All delivered at works.

Steel.

A rather more hopeful view of the position is now current in Sheffield steel trade circles, based presumably on the more favourable outlook in the industrial dispute, and the circulation of promising inquiries for material at home and abroad. Orders are also coming in, if not on a very substantial scale, for crucible steel, while makers of field and garden tools are reported to be doing a little better business. Some important contracts are also under consideration, or already placed with Sheffield firms, among these being a big order by the Brightside Foundry Company, Limited, for the heating, ventilating and hot-water installation at the Epsom Asylum. In addition, some good orders have been recently placed with a well-known firm for high-speed steel. Another substantial contract secured for Sheffield has been awarded by the New Zealand Government to the Metropolitan Vickers Electrical Company, Limited, amounting to upwards of £30,000, for the supply of switch gear for an electric installation for Wellington. A different story is, however, told in connection with other branches of the trade, in which it is affirmed that current prices of ingots, billets and other semi-products are quite unremunerative, makers having cut quotations below a profitable basis in order to stimulate demand. In Lancashire most of the steelworks are but indifferently supplied with orders, as is also the case on Tees-side and Barrow-on-Furness, the rail mills in the latter district remaining idle, and the general foundry trade quiet. Steel-makers engaged in the production of railway material are awaiting the placing of long-delayed orders by the companies.

Metals.

Copper.—The improvement recently noted in standard copper values has been well maintained during the past week, and although movements have only been limited in range, the tone throughout has been steadily confident, with buying transactions in fairly good volume for prompt and forward business. The statistical position shows a decrease of stocks of 2,157 tons for March, now standing at 15,868 tons, while stocks in America are also reduced. It is, however, reported that three mines in the States have resumed operations, without, so far, affecting prices. Electrolytic and wire bars have appreciated in values following the advances in standard copper. Closing prices :—Cash : Wednesday, £58 2s. 6d.; Thursday, £58 7s. 6d.; Friday, £58 17s. 6d.; Monday, £57 2s. 6d.; Tuesday, £57 2s. 6d. Three Months : Wednesday, £58 15s.; Thursday, £59 2s. 6d.; Friday, £59 12s. 6d.; Monday, £57 17s. 6d.; Tuesday, £57 17s. 6d.

Tin.—The market for standard tin during the past week has taken a more active turn, stronger buying having been influenced by a slightly better demand on home consumption account, with forward business influenced by purchases by American interests. Towards the week-end values advanced, with April dates selling at £145 15s., late May at £146 10s., and early June at £146 15s. English ingots also advanced from £144 to £147. The arrivals of tin last week were : London, 625 tons ; Liverpool, 50 tons. Closing prices :—Cash : Wednesday, £143 17s. 6d.; Thursday, £144 2s. 6d.; Friday, £147; Monday, £143 7s. 6d.; Tuesday, £144 17s. 6d. Three Months : Wednesday, £145 10s.; Thursday, £145 15s.; Friday, £148 5s.; Monday, £143 12s. 6d.; Tuesday, £145 2s. 6d.

Spelter.—A fair volume of business has been transacted in the market for this metal, buying on galvanisers' account having been slightly improved with values showing a firmer tendency on the whole. Closing prices :—Ordinary brands : Wednesday, £26 7s. 6d.; Thursday, £26 7s. 6d.; Friday, £26 5s.; Monday, £25 12s. 6d.; Tuesday, £25 12s. 6d.

Lead.—The market for soft foreign pig is practically unchanged, conditions remaining generally steady, with prompt sales reported at round about £22 5s. English qualities continue firm. English closing prices : Wednesday, £23; Thursday, £23; Friday, £23 5s.; Monday, £23; Tuesday, £23.

British Moulding Machines

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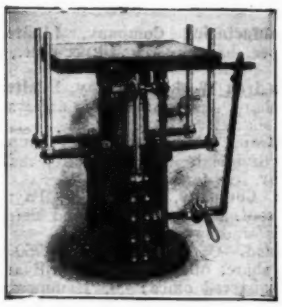

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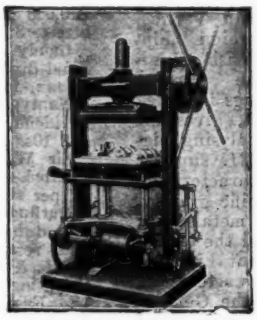

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Book Review.

Giesserei-Handbuch. Issued by the Association of German Ironfoundries.—Munich: R. Oldenbourg, Glückstrasse 8. (Price, bound, 300 marks.)

This is an exceedingly useful handbook and book of reference for ironfounders, issued by the Foundry Union of the Association of German Ironfoundries in Düsseldorf, with 34 illustrations in the text and four folding plates of tables. The first of its 21 divisions gives résumés of specifications issued by various authorities, railway and other administrations and bodies in eight different countries for the supply of iron and steel castings, including those issued by the Bureau Veritas, Lloyds' Register of British and Foreign Shipping, the German Lloyd, the British Engineering Standards Committee, the German Navy, etc., prescribing tests for castings intended for various purposes, etc. Section II. gives the standard methods of sampling and analysing pig-iron, coal and coke, while Section III. supplies information about the physical characteristics fusing point, rate of contraction, specific gravity, weights of cast iron and some other metals, etc. In further brief sections are tabulated the chemical composition of the most important kinds of cast iron, analyses of cupola slags and waste gases, of refractory materials for cupolas, the German standard dimensions and weights of spigot and socket and flanged cast-iron pipes. Next we have an extract from the German Customs tariff as far as it concerns castings, with an alphabetical list of these. Statistics follow, next, of prices from 1913 to 1921 (both inclusive) in Germany, the number and output of German foundries in 1913 and 1916, with detailed information of their plants, consumption of materials, wages, and a few statistics of foreign countries. A list of technical periodicals of use to foundrymen follows next, and of the various foundry and cognate associations in Germany, and some fifteen other countries. The rest of the volume contains a complete directory of German iron and steel foundries in alphabetical order and also grouped according to their principal products, a list of some other metal foundries, a buyer's guide, a list of blast furnaces in Germany, and, finally, information about the Cast Iron Scrap Purchase Concern.

The question of cast-iron test bars is now being studied by a committee of the Institution of British Foundrymen, and we are of opinion that they would do well to avail themselves of the information contained in this volume.

Gazette.

Mr. B. Porritt, Eddercliffe, Liversedge, metal broker, was adjudicated bankrupt on March 31.

The St. Anthony's' Foundry, St. Anthony's Hill, Seaside, Eastbourne, are paying a first and final dividend of 8½d. in the £.

Trading in the style of British Steels, Messrs. V. Dale and A. Fink, 36, Cannon Street, Birmingham, steel merchants, have dissolved partnership.

A receiving order has been made under date March 27 in the case of Mr. J. Oxley, Cadman Chambers, Norfolk Street, Sheffield, iron, steel and machinery merchant.

The partnership heretofore subsisting between Messrs. J. W. Irvine and A. O. Hunter, iron founders, engineers, etc., Hebburn-on-Tyne, trading under the style of Irvine & Hunter, has been dissolved.

Messrs. E. R. Gillespie and H. E. Mayhew, iron and steel merchants, 14 and 15, Billiter Buildings, Billiter Street, London, E.C., trading under the style of Gillespie & Mayhew, have dissolved partnership.

Trading in the style of T. Black & Company, Messrs. F. G. Black and J. A. Watson, Newcastle-on-Tyne, iron and steel merchants, have dissolved partnership. Debts by Mr. F. G. Black, who continues the business.

Aluminium Coins in Germany.—Germany shortly intends to meet to some extent the widely expressed desire for the abolition of the present insanitary paper currency by issuing coins of one, two, three and five marks, all of which (except that for one mark) will be made of aluminium with an internal layer of copper The one-mark piece will be of pure aluminium.

Company News.

Weardale Lead Company, Limited.—Interim dividend passed.

Skinner & Holford, Limited.—Dividend on cumulative preference shares deferred.

Dutton, Massey & Company (Liverpool), Limited.—Capital £35,000 in £1 shares. Merchants.

Furness, Withy & Company, Limited.—Interim ordinary dividend, 5 per cent. per annum, free of tax.

Brown Bayley's Steel Works, Limited.—Preference dividend deferred; no interim ordinary dividend.

W. G. James, Limited.—Capital £5,000 in £1 shares. Engineers. Registered office: 14, Mortimer Street, W.

British Reverberatory Furnaces, Limited.—Capital £10,000 in £1 shares. Registered office: 82, Victoria Street, S.W.

Gandy Belt Manufacturing Company, Limited.—Final dividend, 1s. per share, making 10 per cent., free of tax, for year.

Nantyglo & Blaina Iron Works Company, Limited.—Dividend, £2 per share, on account of arrears on £62 10s. preference shares.

Sir W. G. Armstrong, Whitworth & Company, Limited.—Ordinary dividend, 6d. per share, making 1s. per share for year, less tax.

Darlington Forge Company, Limited. — Payment second half 7 per cent. preference dividend deferred until result of year's trading ascertained.

Cole & Sons, Limited.—Capital £5,000 in 4,750 participating preference shares of £1, and 5,000 ordinary of 1s. Engineers. Registered office: 44, Hammersmith Road, W.

Brush Electrical Engineering Company, Limited.—Total balance, including £141,983 brought in, £374,585; ordinary dividend, 15 per cent. per annum for year; reserve, £73,190; carried forward, £214,074.

J. H. Bardsley, Limited. — Capital £15,000. Engineers, etc. Directors: J. H. Bardsley (permanent managing director), F. P. Webster and A. Bullock. Registered office: 17, St. Ann's Square, Manchester.

Webster & Company (Sheffield), Limited. — Capital £30,000 in £1 shares. Manufacturers of silica bricks, ground ganister, etc. Directors: R. Webster, J. H. Bloomer and H. Swift. Registered office: Millhouses, near Sheffield.

Douglas Elliot & Company, Limited.—Capital £25,000 in £1 shares. Steel merchants. Directors: H. Illingworth, D. Illingworth and H. S. Hutchinson. Secretary: D. Illingworth. Registered office: Atlas Chambers, King Street, Leeds.

Baker & York, Limited.—Capital £1,000. To manufacture and sell a patent improved moulding machine. Permanent directors: W. York (managing director), E. Baker, J. T. Wheatley and J. Wheatley. Registered office: Victoria Works, Woods Street, Ilkeston, Derby.

Personal.

Sir Ernest Rutherford has been nominated as president of the British Association for the year 1923—1924.

Mr. F. J. Pullan, secretary and general manager of Joseph Rodgers & Sons, Limited, Sheffield, has been elected managing director of the company.

Mr A. T. Jenkins, chairman of Robert Jenkins & Company, Limited, boiler makers, etc., Rotherham, has been re-elected chairman of the Rotherham Chamber of Commerce.

Lt.-Colonel Sir Philip Richardson, who has been returned Member of Parliament for Chertsey, Surrey, is a director of Swan, Hunter and Wigham Richardson, Limited.

Mr. A. H. Hayes, Mr. C. H. Thurner, Mr. C. Stein, and Mr. M. J. B. Whitby have been admitted as partners in the firm of George Warren & Company, metal merchants, 34, Lime Street, London, E.C.3.

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